1991 Parkway Blvd., SLC. Utah 84119
1-800-441-9910

Using the CH2 to Test Relays, Lamps, and Other Devices Requiring Power

A new capability has been added to the CH2 that allows testing of assemblies containing relays. Relay testing uses the new easy-wire Actuate and Energize instruction software along with the CH2 relay Energization Unit (E Unit).

Hardware

A CH2 relay energization unit consists of a scanner node card (revision 1H or later) and standard scanner modules. The energization unit has a special back panel with an input plug for an external power supply. Cirris will provide the external power supply (perhaps from the Astec DPS-50 series) with the energization unit. The voltages available in the DPS-50 series are 5, 12, 15, 24, and 48 Volts. The voltage of this power supply must be selected to match the relay coil voltage of the assembly under test. The energization unit contains circuitry to monitor and control the current provided by the external power supply. The output of this circuit will henceforth be referred to as the relay energization supply. The voltage supplied by the relay energization supply circuit is the same as the external power supply voltage.

The energization unit is connected to the CH2 system using box to box cables just like any other scanner unit. For each relay to be tested, fixturing should connect the high side of the relay coil to a point on the energization unit and connect the low side of the relay coil to another point on the energization unit. If there are ten relays in the assembly, as many as twenty energization points would be required to do the test. Less energization points would be needed if any of the relay coils were connected in common.

The points in the energization unit are NOT regular test points and do not show up in the easy-wire test point list. Instead, they show up as energization points for use with the Actuate and Energize instructions. Energization points can be connected to test points without damage to the tester. However, avoid measurements to any circuit path that includes active energization points as this can lead to invalid measurement results.

To achieve thorough test coverage of the assembly under test, the interfacing should connect one test point to each relay energization point used in the test. With this so-called “Y” cable set up, the relay coil resistances can be verified and unintended connections between coils and contacts can be found. In the present implementation energization points are referenced by their point number and cannot be labeled.

Software

To test an assembly containing relays, a dual test approach is recommended. The first (Precursor) test is set up to thoroughly check the assembly for unintended shorts and opens with no relays energized. The following (Subsequent) test sequentially activates relays or groups of relays and checks the resulting opens and closures. The Precursor test takes advantage of the shorts detection algorithm, cable detection algorithm, and hipot testing built into easywire. Automatic shorts detection, cable detection, hipot testing, and probe are disabled in the Subsequent test(s) preventing the relays from being accidentally de-energized during testing..

Use the Precursor test to check each relay for proper coil resistance and unintended shorts from contacts to coil. For a given make and model of relay, the energization voltage is correlated to the coil resistance, so testing the coil resistance is a good way of ensuring the correct voltage relays are in place.

Relay energization during the Subsequent test program(s) is accomplished by using the Actuate and Energize instructions.

The format of these instructions is:

Actuate < energization point> E-Plus/E-Minus/no connect
Energize on/off <post instruction delay (millisecond)>

For example:

```
Actuate 17 E-Plus       // connect energization point 17 to relay energization supply positive
Actuate 18 E-Minus      // connect energization point 18 to relay energization supply ground
Energize on 100         // turn on relay power supply and then wait 100 ms for relays to switch
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Actuate and Energize instructions can be used anywhere within a test program. The energization supply must be turned off (Energize off) prior to issuing any Actuate commands or a test error will result. Any circuit configuration that draws more than 1 Amp from the energization supply will cause a test error and turn off the energization supply.

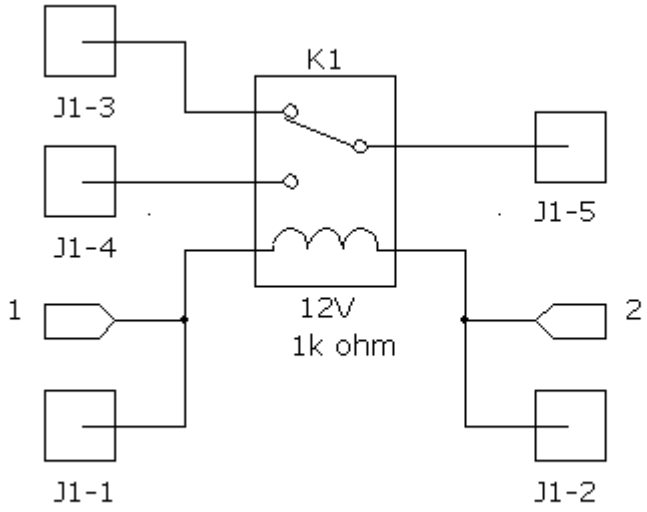
The energization supply is automatically turned off at the beginning and at the end of each test program. If a test program contains Actuate or Energize instructions, easy-wire will not use the built in shorts test to check for unintended connections. The automatic cable detection (cable present) and probe functions are also disabled in Subsequent test(s).

The Precursor test program can be created using the test editor test importer, or the easywire learn function. The Subsequent test(s) can only be created using the test editor or the test importer. Hipot testing is possible in the Precursor test, but is not available for the Subsequent test(s).

Error Conditions

- Actuate command attempted while relay energization supply powered on
- Energization supply current limit exceeded
- Hardware does not support Actuate or Energize commands

Example #1 one relay:



Precursor test

```
Resistor J1-1 J1-2 1k 10%       // test K1 coil resistance
Wire J1-3 J1-5                  // test K1 Normally Closed (NC) contact closure
                                // automatic shorts test happens here
```

Subsequent test

```
Actuate 1 E-Plus
Actuate 2 E-Minus       // connect K1 coil
Energize on 15          // turn on energization supply and then wait 15 ms for K1 to switch
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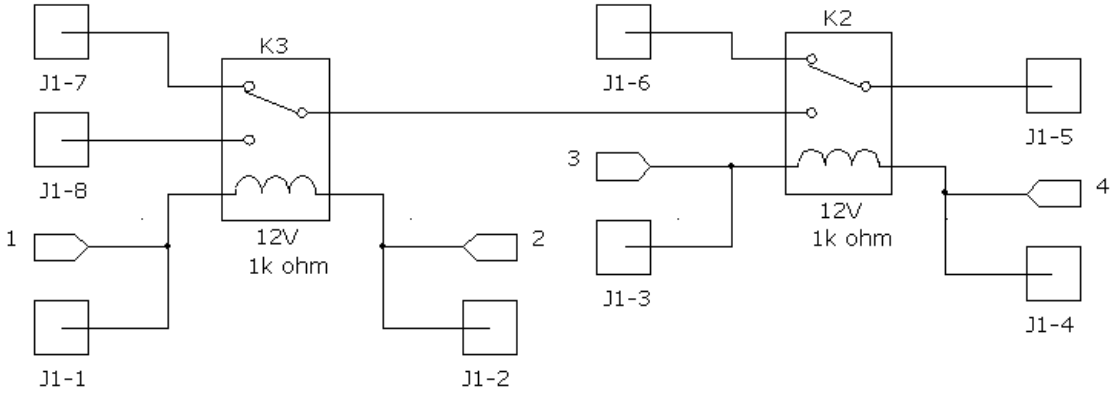
Close J1-4 J1-5 // test K1 Normally Open (NO) contact closure
Open J1-3 J1-4 // test K1 NC contact closure

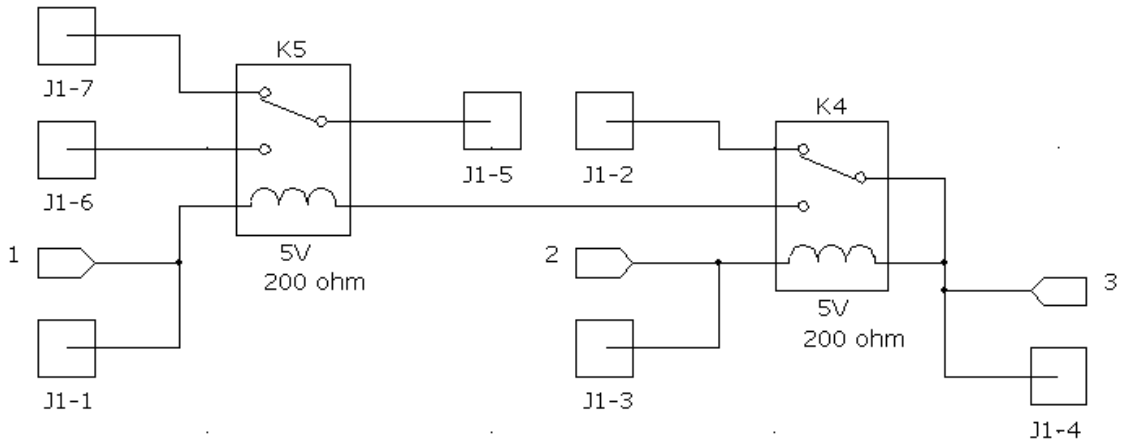
Example #2 two relays in series:



Precursor test
Resistor J1-1 J1-2 1k 10% // test K3 coil resistance
Resistor J1-3 J1-4 1k 10% // test K2 coil resistance
Wire J1-5 J1-6 // test K2 NC contact closure
// automatic shorts test happens here

Subsequent test
Actuate 3 E-Plus
Actuate 4 E-Minus // connect K2 coil
Energize on 15 // turn on energization supply and then wait 15 ms for K2 to switch
Close J1-5 J1-7 // test K2 NO and K3 NC contact closure
Open J1-5 J1-6 // ensure K2 NC contact is open
Open J1-5 J1-8 // ensure K3 NO contact is open
Energize off // turn off energization supply
Actuate 1 E-Plus
Actuate 2 E-Minus // connect K3 coil
Energize on 15 // turn on energization supply and then wait 15 ms for K3 to switch
Close J1-5 J1-8 // test K2 and K3 NC contact closure
Open J1-5 J1-6 // ensure K2 NO contact is open
Open J1-5 J1-7 // ensure K3 NO contact is open

Example #3 two cascading relays:



Precursor test
Resistor J1-3 J1-4 200 10% // test K4 coil resistance
Wire J1-4 J1-2 // test K4 NC contact closure
Wire J1-5 J1-7 // test K5 NC contact closure
Subsequent test
Actuate 2 E-Plus
Actuate 3 E-Minus // connect K4 coil
Energize on 25 // turn on energization supply and then wait 25 ms for K4 to switch
Resistor J1-1 J1-4 200 10% // test K5 coil resistance (safe because only one test point is energized)
Open J1-2 J1-4 // ensure K4 NC contact is open
Close J1-5 J1-7 // test K5 NC contact closure
Open J1-5 J1-6 // test K5 NO contact is open
Energize off // turn off energization supply
Actuate 1 E-Plus
Energize on 50 // turn on energization supply and then wait 50 ms for K4 then K5 to switch
Close J1-6 J1-5 // test K5 NC contact closure
Open J1-5 J1-7 // ensure K5 NO contact is open
Open J1-2 J1-4 // ensure K4 NC contact is open

Specifications

- Energization voltage: 5 to 48 VDC
- Maximum total energization current: 1 Amp
- Number of energization points: 160 to 800 points in 160 point increments (must be in one unit)
- CH2 input protection: Up to 60VDC or 60VAC peak (no more than 1 amp current)